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(54) **DRIVE COMPONENT FOR ELECTRIC SHAVER**

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(51) **Int. Cl.**
B26B 19/14 (2006.01)

(52) **U.S. Cl.**
CPC ***B26B 19/14*** (2013.01); ***B26B 19/141*** (2013.01)

(58) **Field of Classification Search**
CPC B26B 19/14; B26B 19/141
USPC 30/43.4
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,379,880	A *	5/1921	Seaborn	A61C 1/12 279/35
1,983,094	A *	12/1934	Neher	F16D 3/74 464/79
2,242,405	A *	5/1941	Sussman	B26B 19/26 30/346.51
2,280,052	A *	4/1942	Bahr	B26B 19/14 30/41.6
3,472,045	A *	10/1969	Nelsen	A61C 17/005 415/122.1
3,679,035	A *	7/1972	Schmitt	B01D 33/067 192/129 A
RE30,857	E *	2/1982	Tyler	B26B 19/145 30/43.5
4,329,781	A *	5/1982	Schemmann	B26B 19/42 30/34.2

(Continued)

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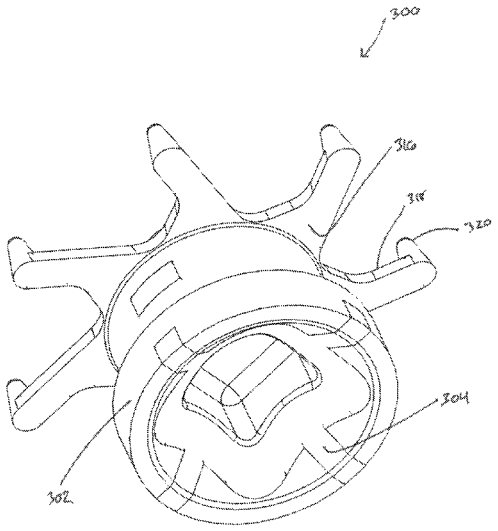
(57) **ABSTRACT**

An electric shaver generally includes a handle and a head connected to the handle. The head includes an outer cutter blade and an inner cutter blade arranged in shearing contact with the outer cutter blade. The electric shaver further includes a drive system having a motor and a plurality of drive components drivingly connecting the motor to the inner cutter blade for driving rotation of the inner cutter blade relative to the outer cutter blade. The plurality of drive components includes a first drive component and a second drive component connected to the first drive component. At least one of the first drive component and the second drive component has a liner for cushioning the interface between the first drive component and the second drive component to mitigate noise associated with operation of the shaver.

20 Claims, 15 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

4,343,086	A *	8/1982	de Vries	B26B 19/42 30/43.6
4,391,594	A *	7/1983	Hannibal	F16D 3/725 464/80
D288,251	S *	2/1987	Izumi	F16D 3/725 D28/45
4,688,329	A *	8/1987	Oord	B26B 19/146 30/43.6
4,729,169	A *	3/1988	Asawa	B26B 19/141 30/346.51
4,841,929	A *	6/1989	Tuggle	F01B 1/12 123/185.3
5,031,315	A *	7/1991	Labrijn	B26B 19/14 30/41
5,035,055	A *	7/1991	McCullough	B26B 25/002 30/276
5,108,273	A *	4/1992	Romanyszyn, Jr.	F04C 2/1073 137/99
5,156,547	A *	10/1992	Bailey	A61C 17/005 433/125
5,423,679	A *	6/1995	Bailey	A61C 17/005 433/125
5,551,918	A *	9/1996	Jones	F16D 3/725 464/147
5,573,463	A *	11/1996	Arlt	F16D 3/76 464/147
5,794,514	A *	8/1998	Pecorari	F04B 1/124 417/269
5,902,107	A *	5/1999	Lowell	A61C 1/12 433/112
6,212,776	B1 *	4/2001	Izumi	B26B 19/14 30/43.4
6,226,870	B1 *	5/2001	Barish	B26B 19/14 30/34.2
6,581,289	B2 *	6/2003	Nakano	B26B 19/145 30/346.51
6,707,208	B2 *	3/2004	Durham	H02K 21/042 310/156.35
7,178,242	B2 *	2/2007	Okabe	B26B 19/141 30/346.51
7,422,433	B2 *	9/2008	Carron	A61C 17/005 433/125
7,698,819	B2 *	4/2010	De Wit	B26B 19/3846 30/43.5
8,915,404	B2 *	12/2014	Farne'	G01F 11/021 1/21
9,027,251	B2 *	5/2015	Schmitt	B26B 19/14 30/41
2002/0083591	A1 *	7/2002	Geertsma	B26B 19/143 30/43.6
2006/0169524	A1 *	8/2006	Born	B62D 1/181 180/444
2007/0084059	A1 *	4/2007	Hannan	B26B 19/14 30/43.5
2013/0053966	A1 *	2/2013	Jimenez	A61F 2/447 623/17.16
2014/0012237	A1 *	1/2014	Pribanic	A61B 17/07207 606/1
2014/0024563	A1 *	1/2014	Heidecker	F04C 15/0003 508/106

* cited by examiner

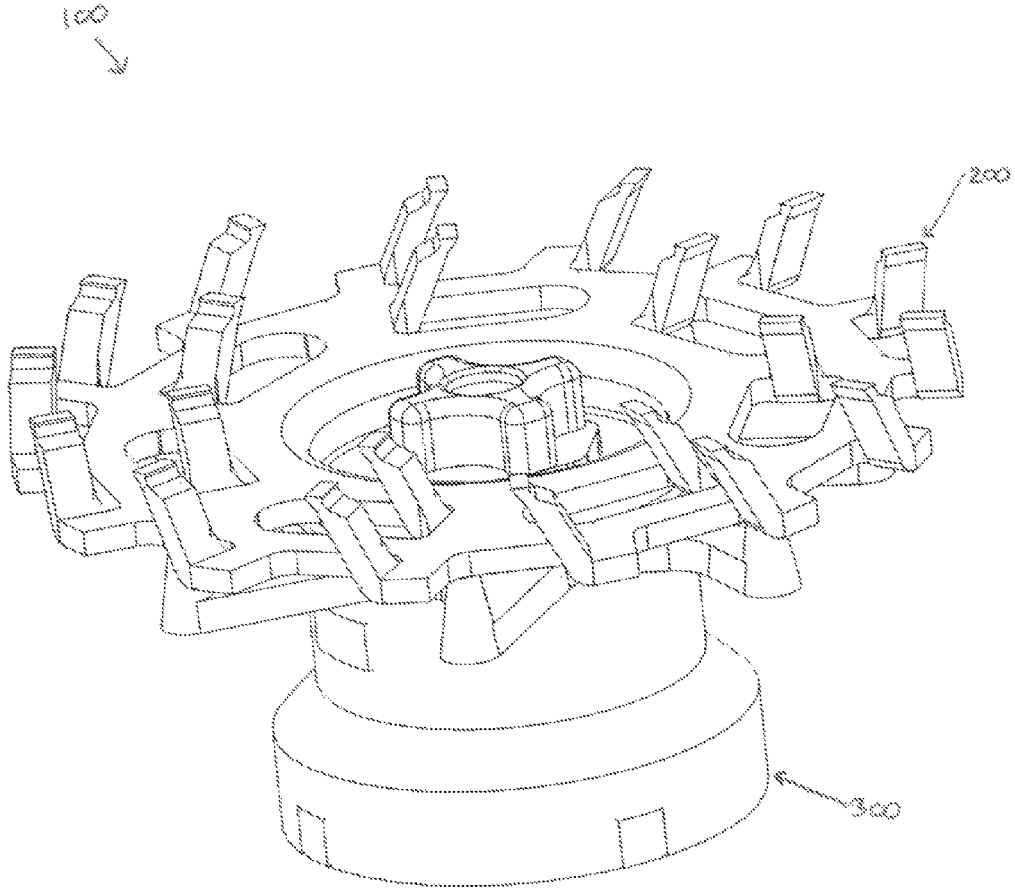


FIG. 1

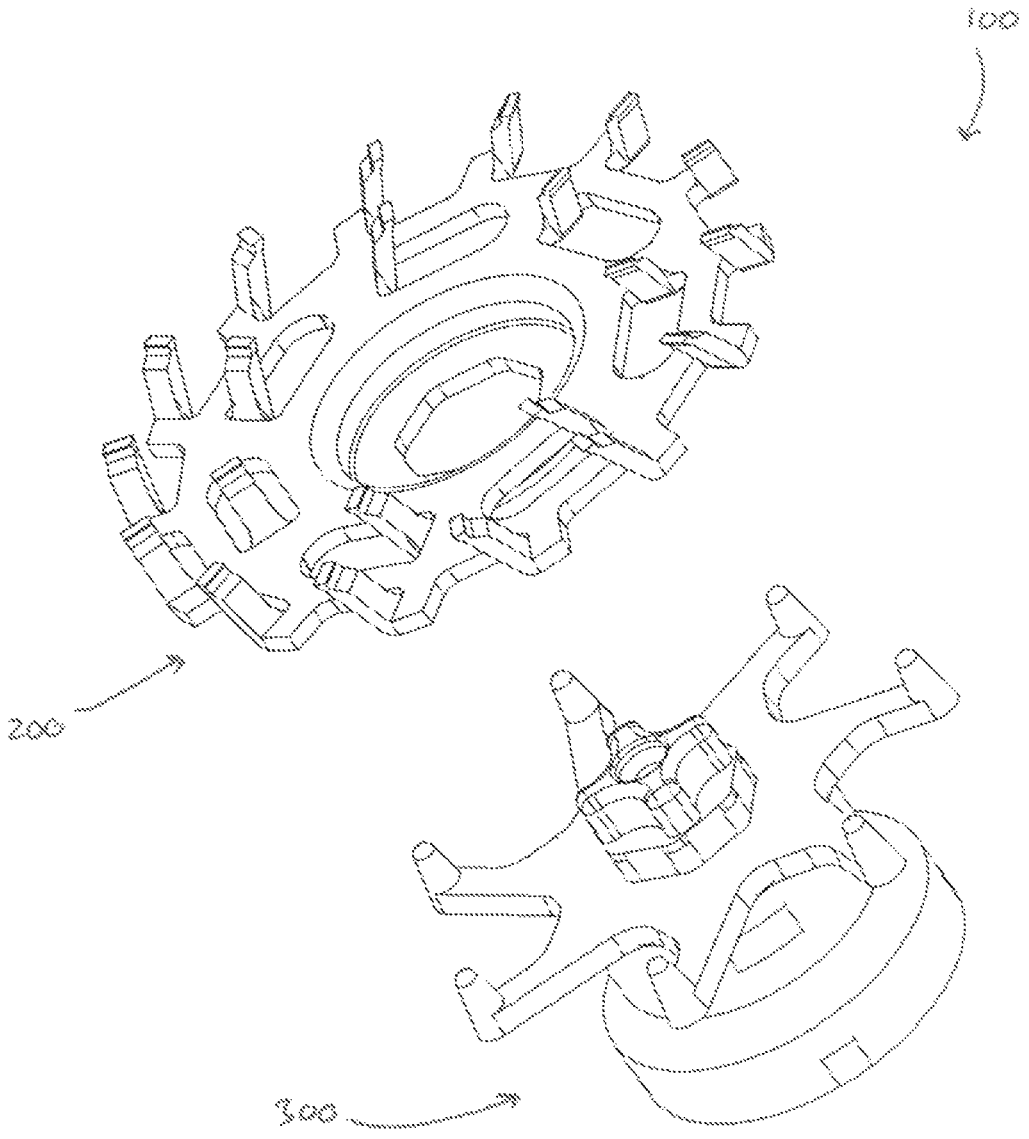


FIG. 2

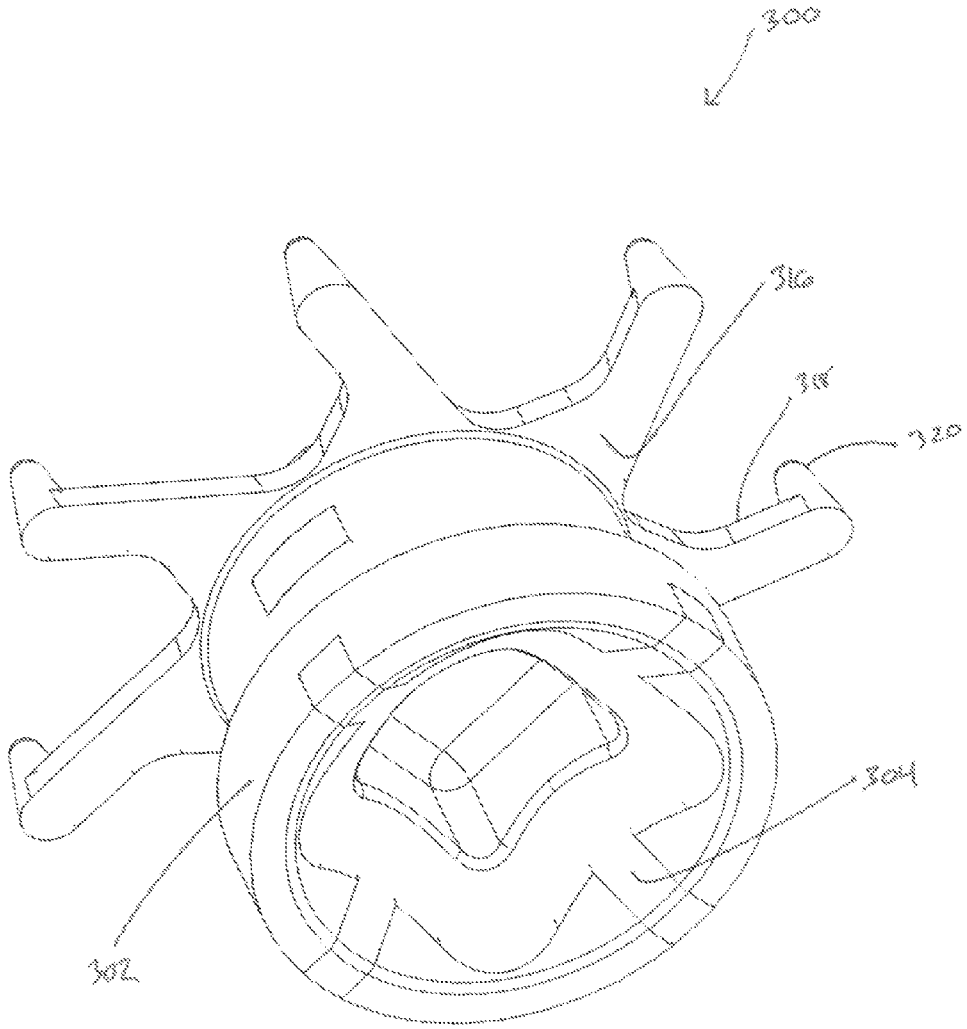


FIG. 3

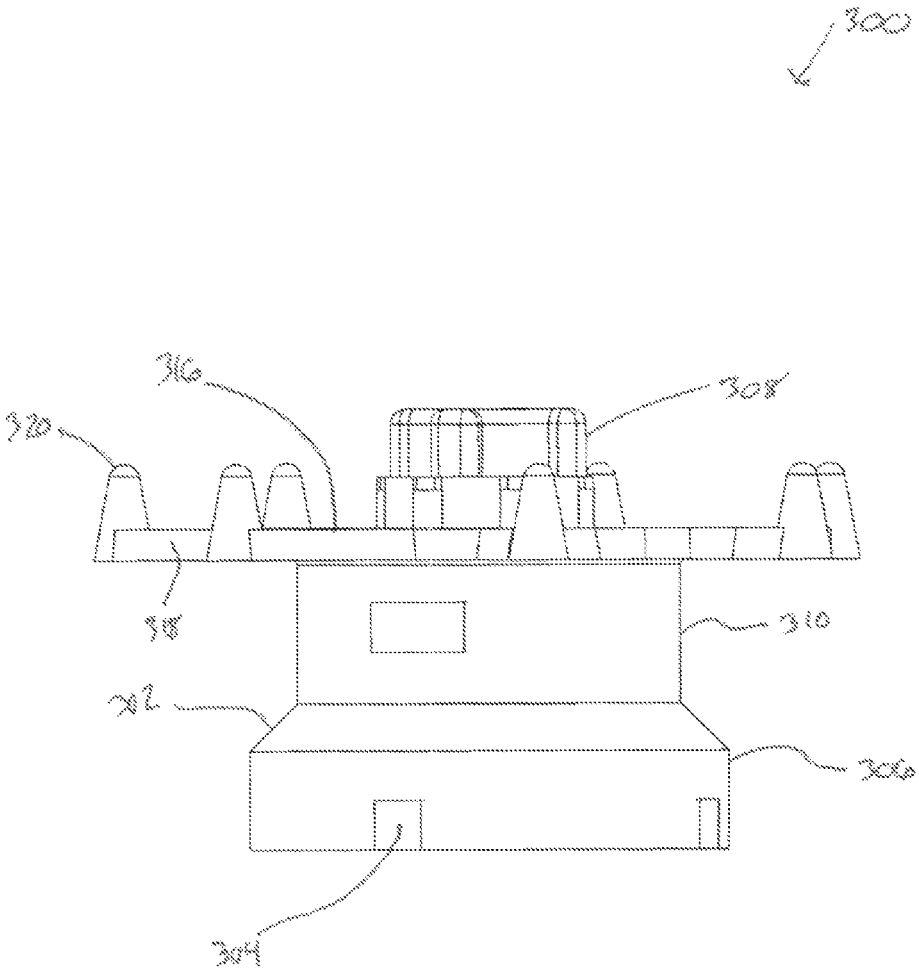


FIG. 4

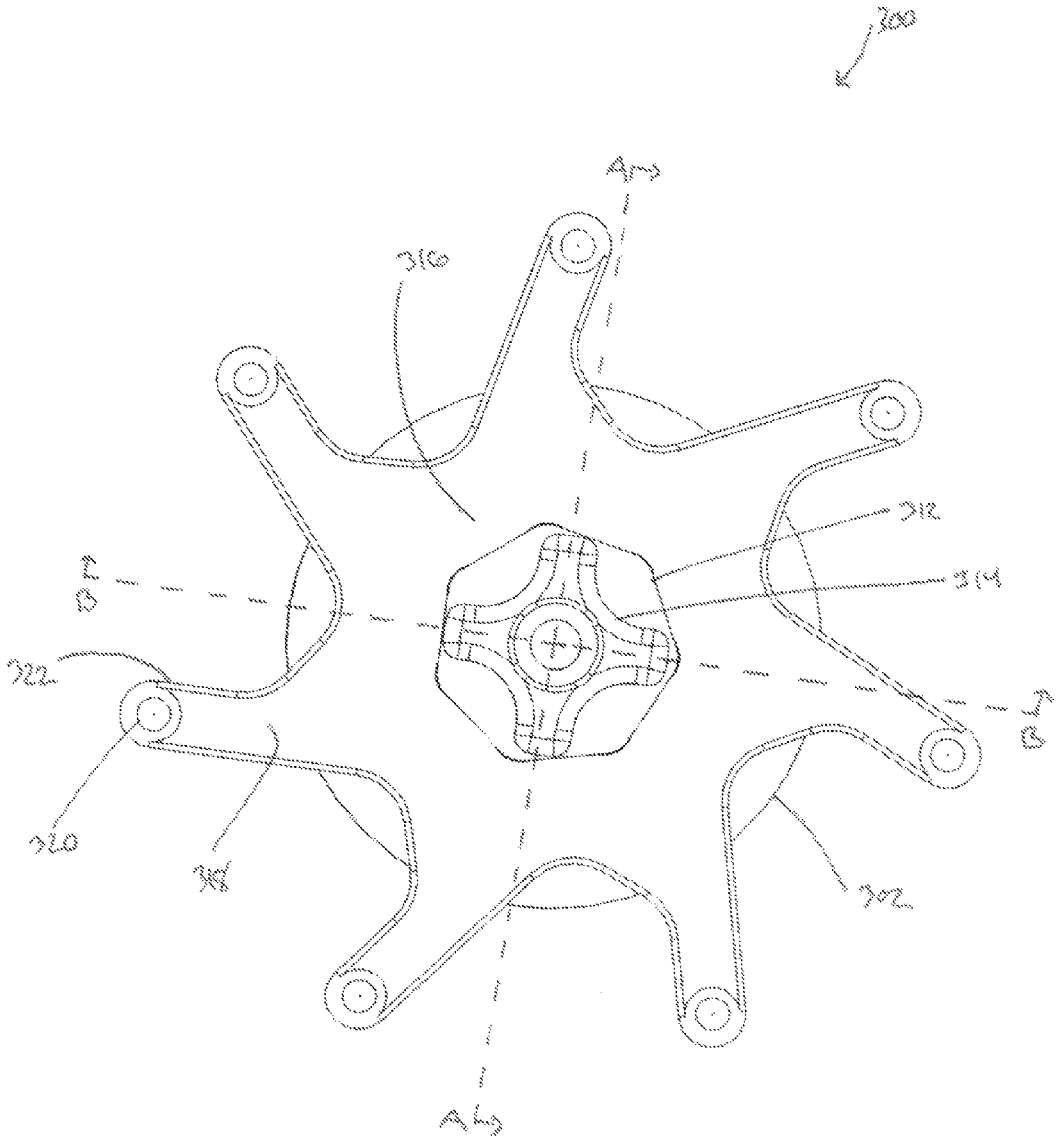


FIG. 5

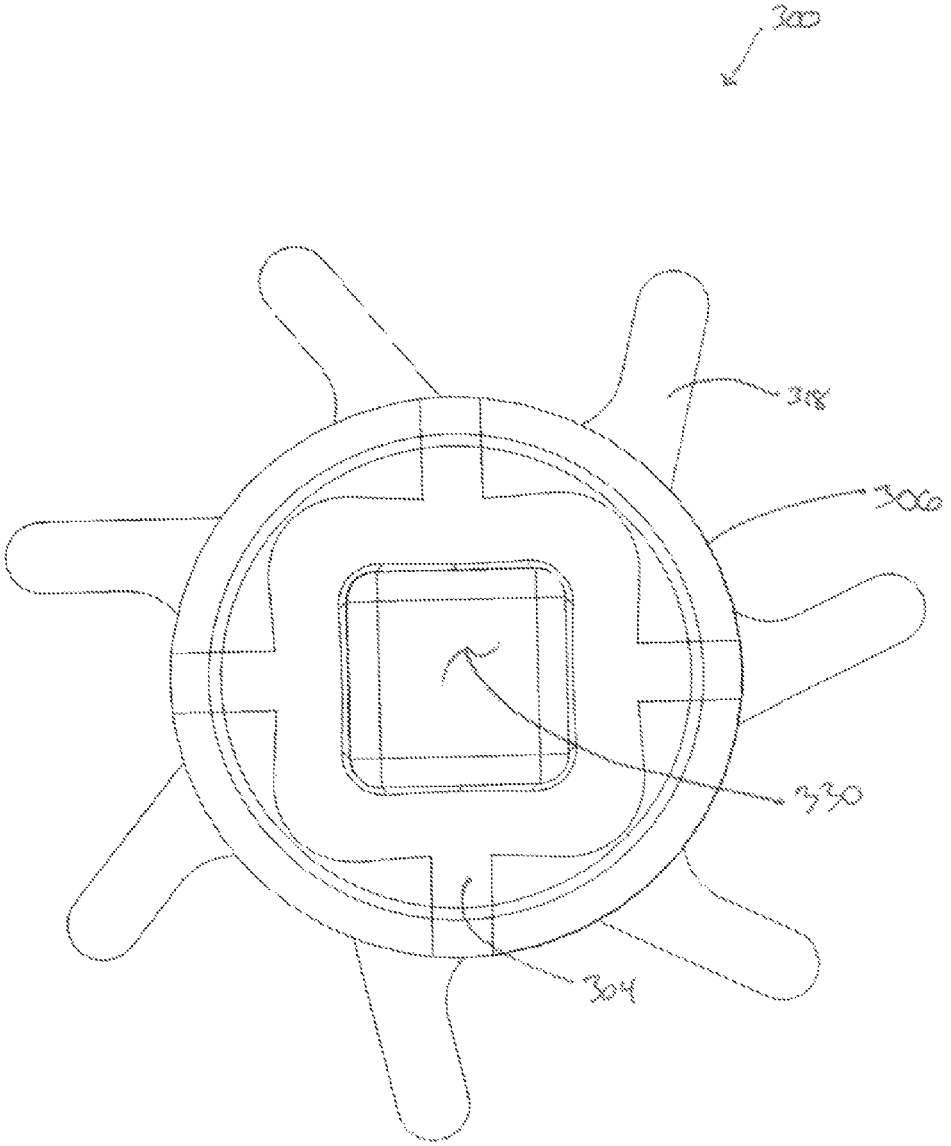


FIG. 6

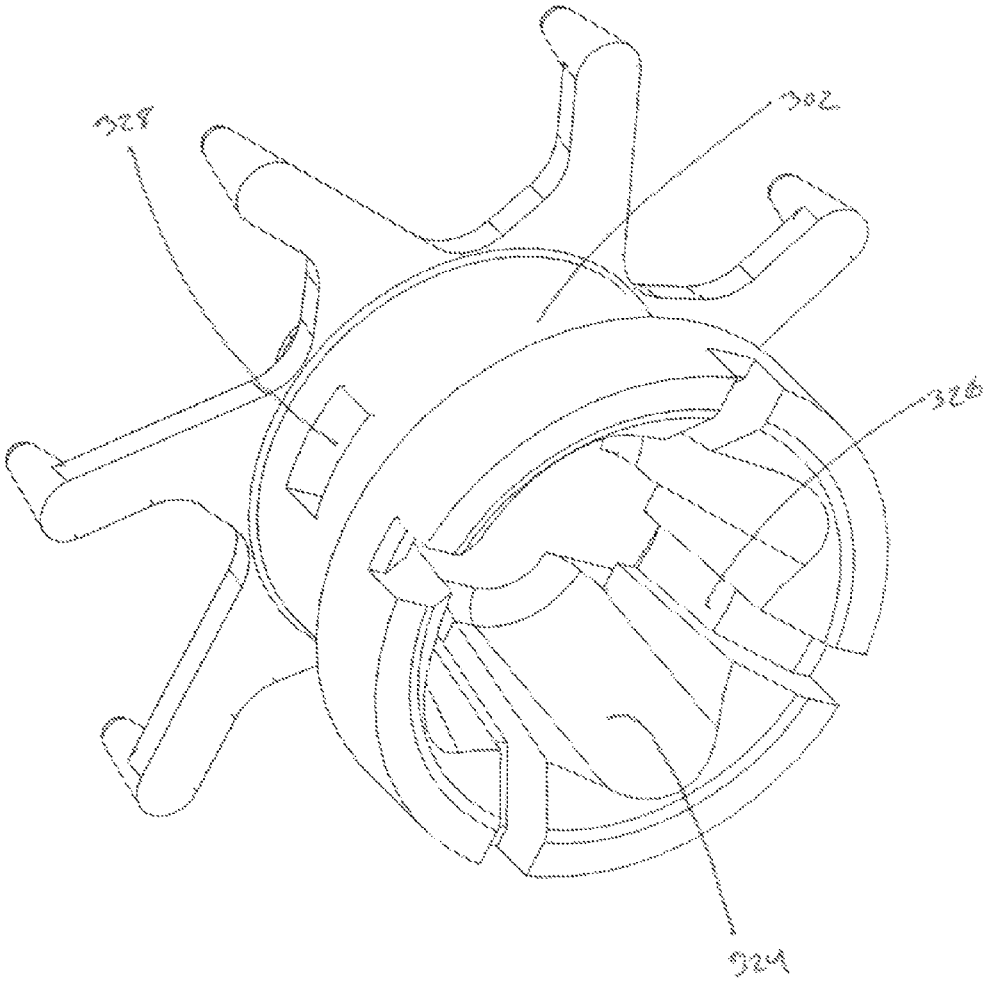


FIG. 7

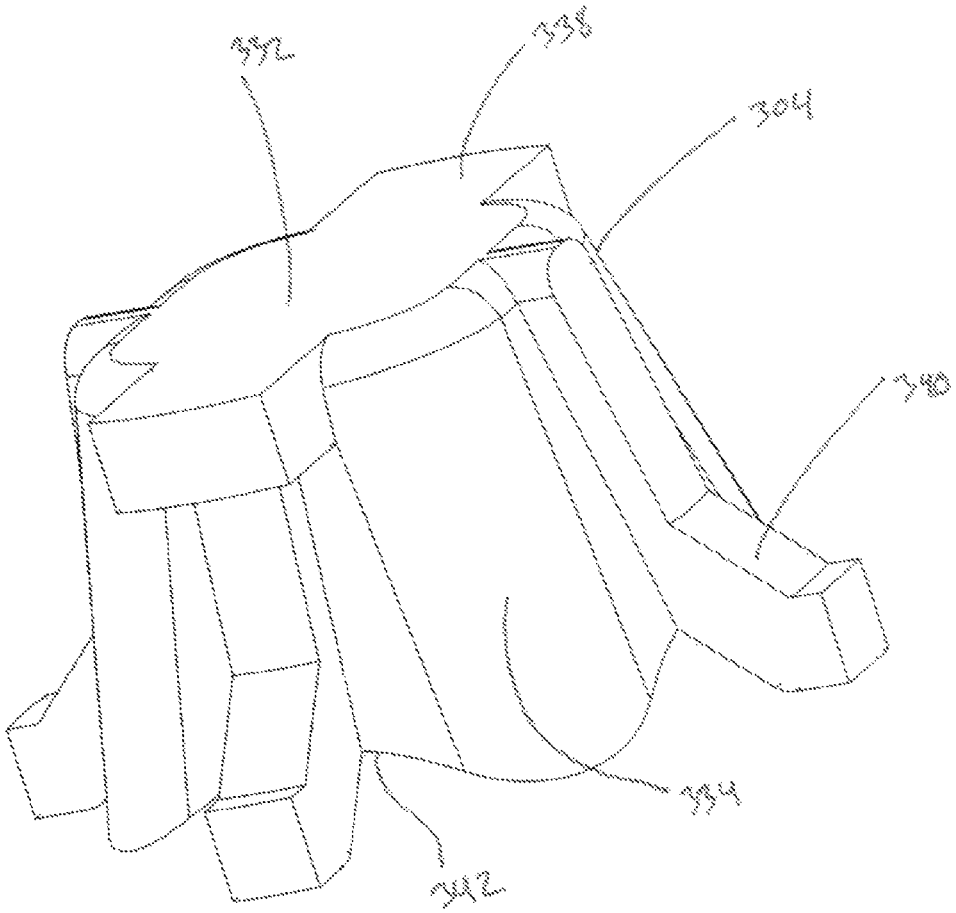


FIG. 8

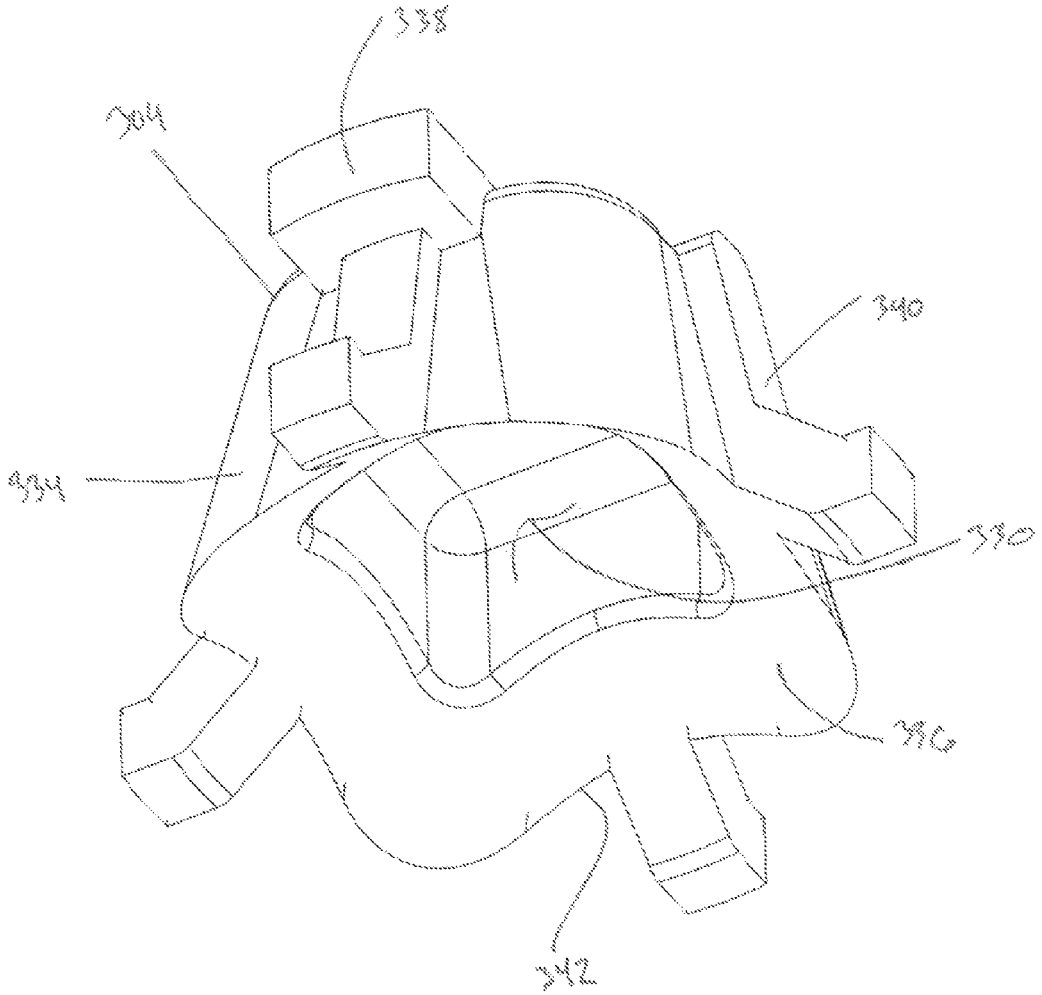


FIG. 9

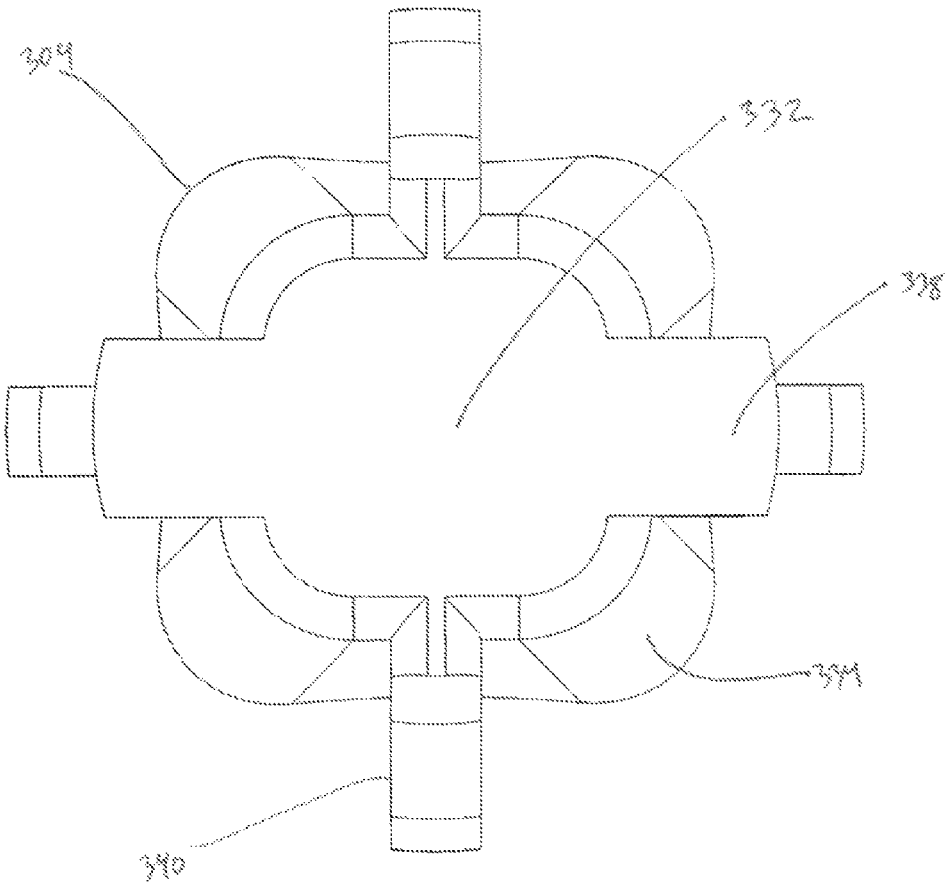


FIG. 10

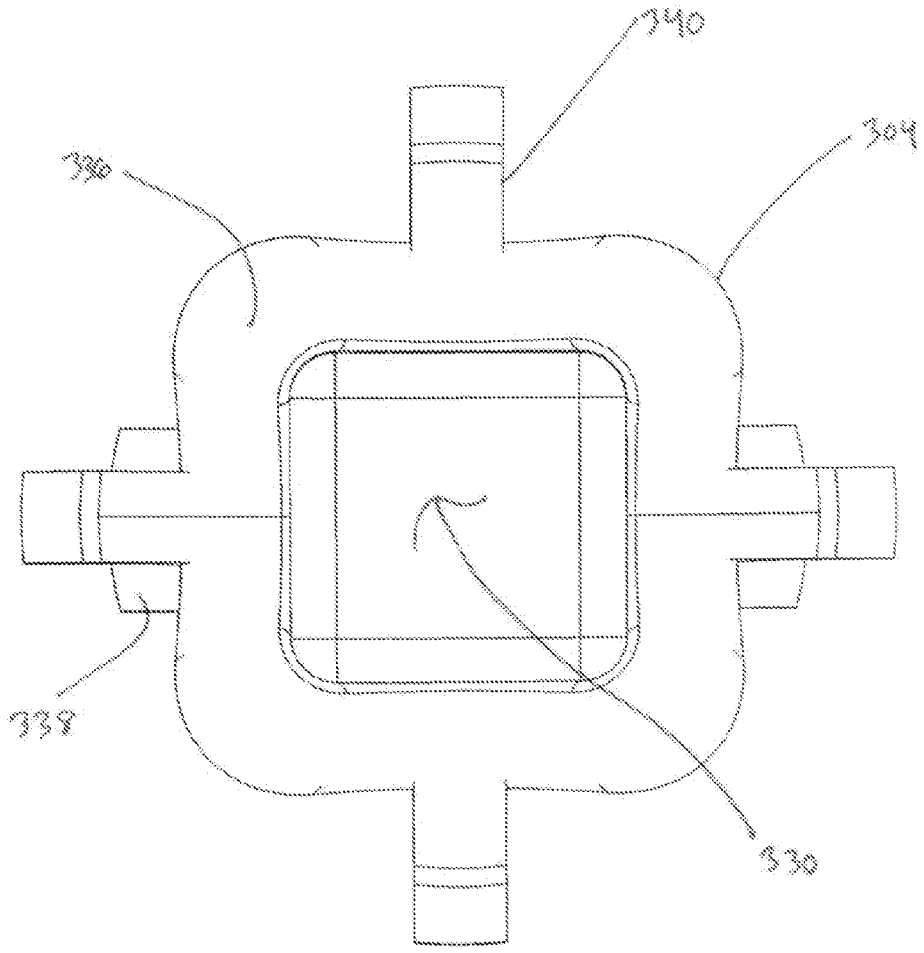


FIG. 11

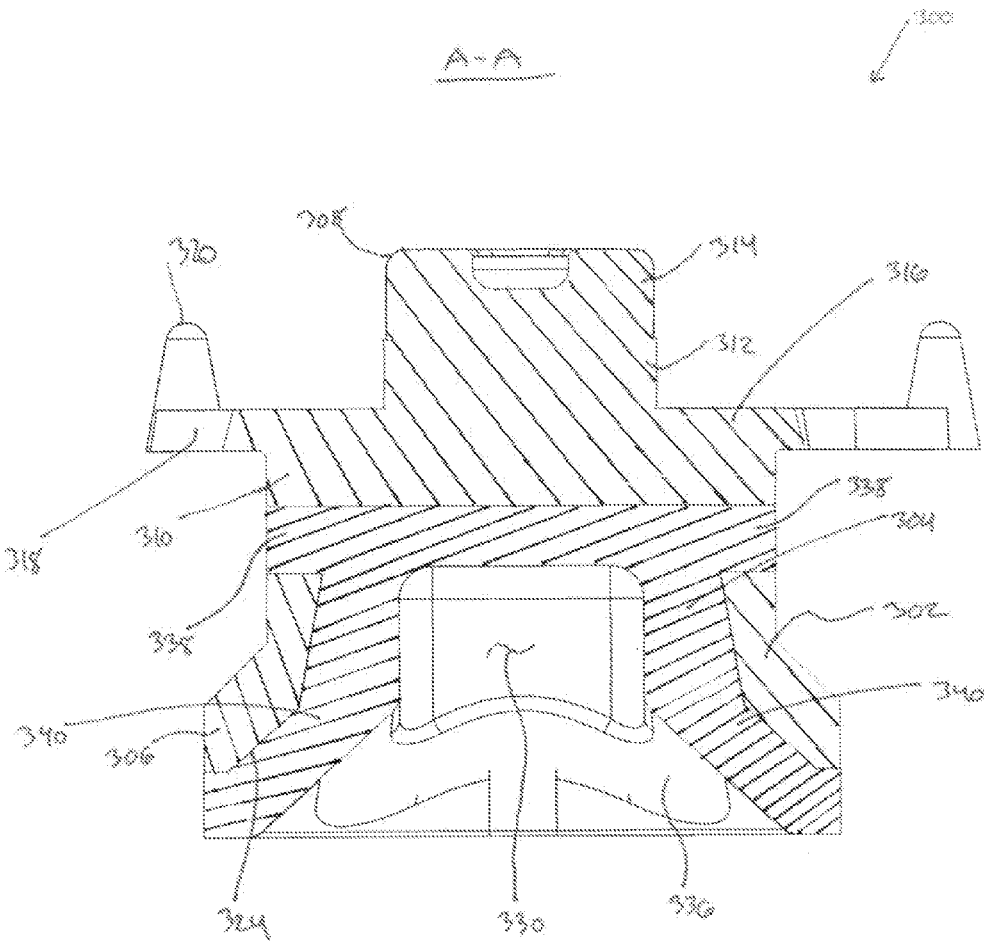

A-A
300
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FIG. 12

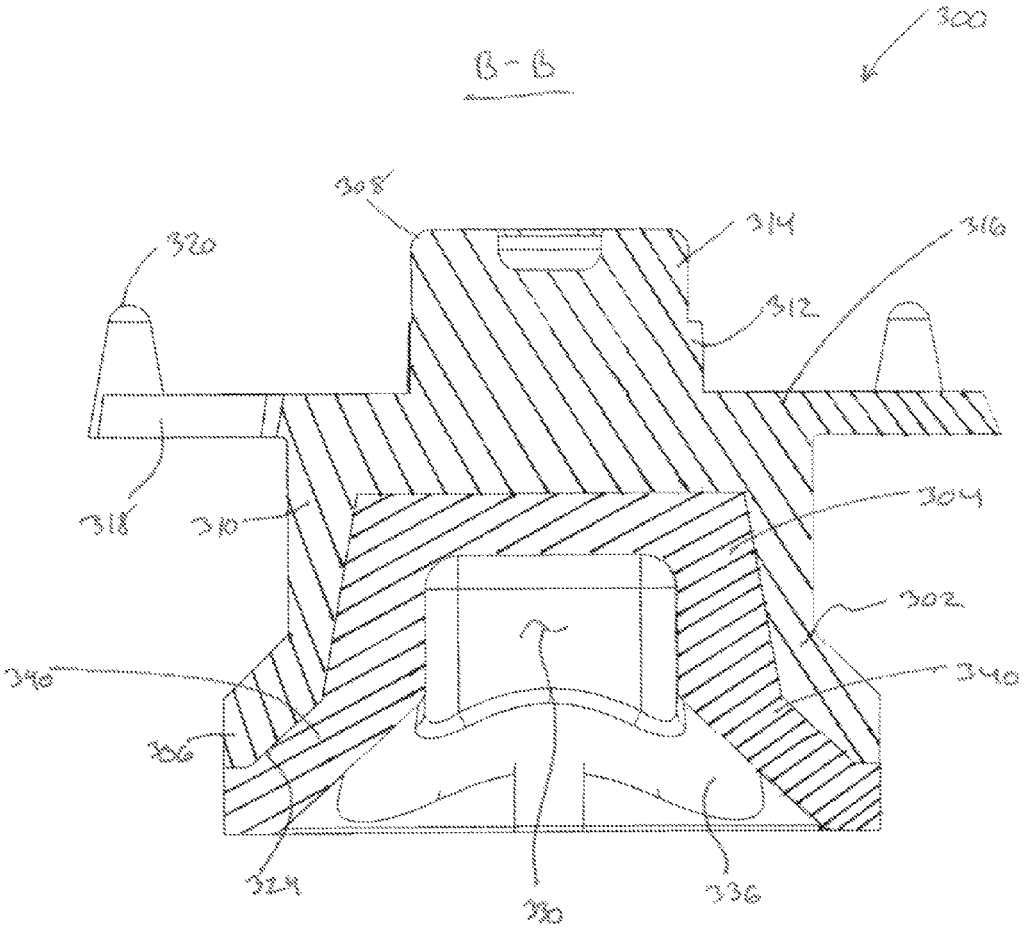

FIG. 13

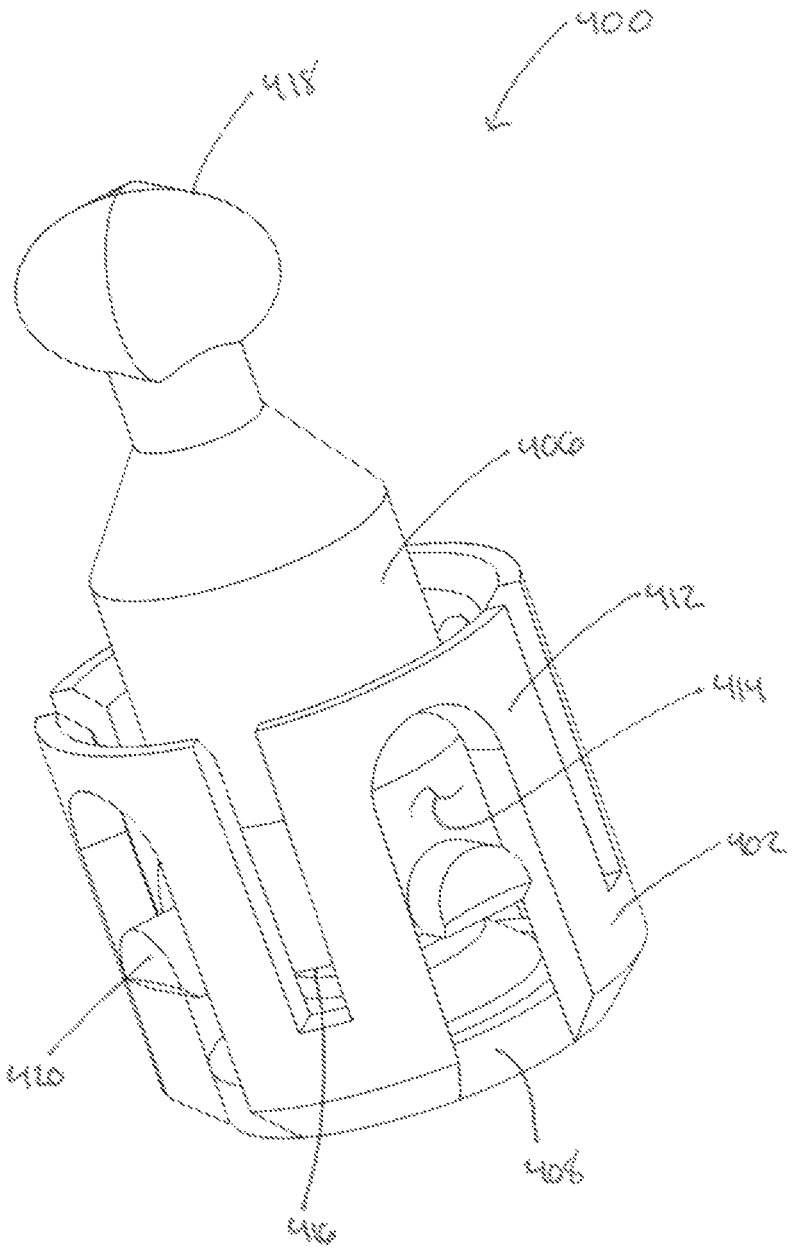

FIG. 14

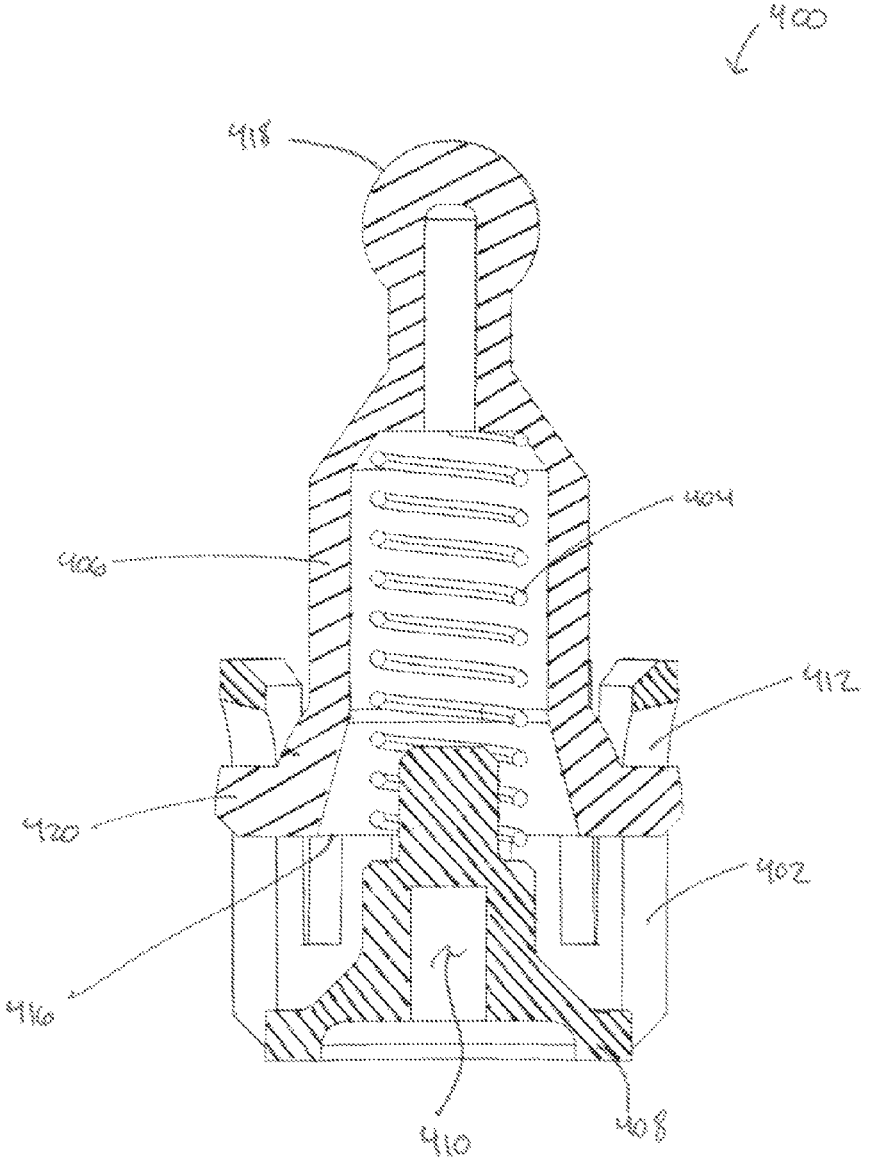

FIG. 15

DRIVE COMPONENT FOR ELECTRIC SHAVER

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority to Provisional Patent Application Ser. No. 61/747,591, filed on Dec. 31, 2012, which is incorporated herein by reference in its entirety.

BACKGROUND

The present invention relates generally to electric shavers and, more particularly, to a drive component for an electric shaver.

Conventional rotary shavers include a handle and a head mounted on the handle, and the head carries at least one set of inner and outer cutters. The outer cutters are typically cup-shaped and are supported by a frame of the shaver head, thereby collectively defining a skin contacting surface of the shaver head. Openings or slits formed in the outer cutters allow hair to protrude through the outer cutters as the shaver head is moved along the skin. Each inner cutter is housed in the shaver head below, and in contact with, a respective one of the outer cutters. The shaver is operated via an electric motor, typically housed within the handle, whereby rotation of the inner cutters by the motor acts to cut hairs protruding through the outer cutters. An arrangement of drive shafts and gears is conventional for operatively connecting the inner cutters to the motor.

The outer cutters of at least some conventional rotary shavers are configured for pivoting movement on the shaver head to facilitate uninterrupted contact of the outer cutters with the skin as the outer cutters are moved along the contours of the skin (e.g., along the skin covering the cheek bones, the jaw line, etc.) Because the inner cutters are disposed within the outer cutters, it is also typical for the inner cutters to be configured for pivoting movement to facilitate maintaining shearing engagement between the inner and outer cutters when the outer cutters pivot.

In that regard, the shaver drive system typically has at least one pivot joint located between the motor and the inner cutters to enable driving of the inner cutters during pivoting. The pivot joint therefore includes at least one rotating component that can pivot relative to another rotating component. However, the engagement of these rotating and pivoting components can be a source of undesirable noise during operation of the shaver. As such, there is a need for a drive system that facilitates quieter operation of a rotary shaver having pivotable cutters.

SUMMARY

In one embodiment, an electric shaver generally comprises a handle and a head connected to the handle. The head comprises an outer cutter blade and an inner cutter blade arranged in shearing contact with the outer cutter blade. The electric shaver further comprises a drive system comprising a motor and a plurality of drive components drivingly connecting the motor to the inner cutter blade for driving rotation of the inner cutter blade relative to the outer cutter blade. The plurality of drive components comprises a first drive component and a second drive component connected to the first drive component. At least one of the first drive component and the second drive component comprises a liner for cushioning the interface between the first drive component and the second drive component to mitigate noise associated with operation of the shaver.

In another embodiment, an inner cutter for an electric shaver generally comprises a blade and a drive cap to which the blade is connected. The drive cap comprises a shell and a liner, wherein an interior of the shell is lined by the liner such that the liner defines a socket. The shell is formed from a first material having a first hardness, and the liner is formed from a second material having a second hardness that is less than the first hardness.

In yet another embodiment, an electric shaver generally comprises a handle and a head connected to the handle. The head includes an outer cutter blade and an inner cutter blade arranged in shearing contact with the outer cutter blade. The electric shaver further includes a drive system comprising a motor and a plurality of drive components drivingly connecting the motor to the inner cutter blade for driving the inner cutter blade relative to the outer cutter blade. The plurality of drive components comprises a drive cap to which the inner cutter blade is connected. The drive cap includes a shell and a liner, wherein an interior of the shell is lined by the liner such that the liner defines a socket. The shell is formed from a first material having a first hardness, and the liner is formed from a second material having a second hardness that is less than the first hardness. The drive system further includes a torque transfer assembly comprising a basket, a biasing member seated within the basket, and a drive pin connected to the basket atop of the biasing member such that the drive pin is floatable, pivotable, and rotatably immovable relative to the basket. The torque transfer assembly drivingly connects the motor to the drive cap with the drive pin inserted into the socket such that the liner cushions the interface between the drive pin and the drive cap to mitigate noise associated with operation of the shaver.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of one embodiment of an inner cutter;

FIG. **2** is an exploded perspective view of the inner cutter of FIG. **1**;

FIG. **3** is a bottom perspective view of a drive cap of the inner cutter of FIG. **1**;

FIG. **4** is a side elevation of the drive cap of FIG. **3**;

FIG. **5** is a top plan view of the drive cap of FIG. **3**;

FIG. **6** is a bottom plan view of the drive cap of FIG. **3**;

FIG. **7** is a bottom perspective view of a shell of the drive cap of FIG. **3**;

FIG. **8** is a top perspective view of a liner of the drive cap of FIG. **3**;

FIG. **9** is a bottom perspective view of the liner of FIG. **8**;

FIG. **10** is a top plan view of the liner of FIG. **8**;

FIG. **11** is a bottom plan view of the liner of FIG. **8**;

FIG. **12** is a cross-sectional view of the drive cap of FIG. **5** taken along plane A-A;

FIG. **13** is a cross-sectional view of the drive cap of FIG. **5** taken along plane B-B;

FIG. **14** is a perspective view of a torque transfer assembly for rotating the inner cutter of FIG. **1**; and

FIG. **15** is a cross-sectional view of the torque transfer assembly of FIG. **14**.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and in particular to FIGS. **1** and **2**, a movable or inner cutter according to one embodiment

is generally indicated by the reference numeral **100**. The inner cutter **100** includes a blade, indicated generally at **200**, and a drive cap, indicated generally at **300**.

With reference now to FIGS. **3-6**, the drive cap **300** includes a shell **302** and a liner **304**. The shell **302** and the liner **304** are each formed from a synthetic or semi-synthetic, organic-based material (e.g., a "plastic" material), as described in more detail below. The shell **302** has a lower portion **306**, an upper portion **308**, and an intermediate portion **310** between the lower portion **306** and the upper portion **308**. The illustrated upper portion **308** has a base **312**, a head **314** projecting from the base **312**, and a platform **316** extending outward from the base **312**. The base **312** has a generally polygonal profile (e.g., a heptagonal profile in the preferred embodiment), and the head **314** has a generally cross-shaped profile. The platform **316** has a plurality of spaced-apart, outward extending arms **318** arranged such that the platform **316** is generally star-shaped or pinwheel-shaped, and a stud **320** projects upward from a distal region **322** of each arm **318**. In this manner, the blade **200** may be seated on the drive cap **300** (e.g., about the base **312** and atop of the studs **320**) for suitable fastening of the blade **200** to the drive cap **300** (e.g., via heat staking of the base **312** over a segment of the blade **200**). In other embodiments, the base **312**, the head **314**, and the platform **316** may be configured in any suitable manner that facilitates fastening the blade **200** to, and supporting the blade **200** on, the drive cap **300** during operation of the shaver.

The illustrated lower and intermediate portions **306**, **310** of the shell **302** are generally cylindrical on the exterior and are hollow on the interior. Lining the hollow interior of the shell **302** is the liner **304**, which is sized to receive a drive pin **406** (FIGS. **14** and **15**) for rotating the blade **200** during operation of the shaver. In the illustrated embodiment, the shell **302** and the liner **304** are formed using a double-injection molding process (i.e., each die has two cavities, which permits the drive cap **300** to be formed in one injection cycle). For example, after the liner **304** is formed in a first cavity of the die, the die is rotated 180°, and the liner **304** is inserted into the second cavity of the die such that the shell **302** is formed on the exterior of the liner **304** in the second cavity. After the shell **302** is formed on the liner **304**, the drive cap **300** is ejected. In other embodiments, the shell **302** and the liner **304** may be formed in any suitable manner (i.e., in any suitable order using any suitable manufacturing process).

FIG. **7** illustrates the interior of the shell **302** without the liner **304**. As described above, the shell **302** is formed over the liner **304** such that the interior shape of the shell **302** mirrors the exterior shape of the liner **304**. More specifically, an interior surface **324** of the shell **302** defines a plurality of spaced-part, lengthwise-extending grooves **326** and a plurality of opposed throughports **328** located above the grooves **326**. In one embodiment, the shell **302** has four grooves **326** that are equally spaced about the interior of the shell **302**, and the shell has two throughports **328**. Each of the throughports **328** is aligned with, and connected to, one of two opposing grooves **326**. Alternatively, the shell **302** may include any suitable number of grooves **326** and any suitable number of throughports **328** arranged in any suitable manner.

FIGS. **8-11** illustrate the liner **304** without the shell **302** (i.e., before the shell **302** has been formed over the exterior of the liner **304**). The liner **304** is generally cup-shaped and is inverted to define a socket **330**. The liner **304** is closed at the top by a top wall **332** and is open at the bottom within a side wall **334** having an undulating bottom surface **336**. The top wall **332** has a pair of opposed ledges **338** extending outward near the top of the side wall **334**, and the side wall **334** has a plurality of generally L-shaped tongues **340** projecting therefrom and extending downward from the top wall **332** beyond valley regions **342** of the undulating bottom surface **336**. In the illustrated embodiment, the liner **304** has four tongues **340** that are equally spaced-apart from one another, and a pair of the tongues **340** is aligned with the opposed ledges **338** such that each of the opposed ledges **338** is connected to one of the tongues **340**. In other embodiments, the liner **304** may have any suitable number of ledges **338** and tongues **340** arranged in any suitable manner.

In one embodiment, the liner **304** is formed from a thermoplastic elastomer (TPE) material. In the illustrated embodiment, the TPE material is a thermoplastic polyurethane (TPU) material that is polyether-based (e.g., the "Elastollan 1174D" material produced by BASF), which provides the liner **304** with desirable noise mitigation properties and wear resistance properties, as described in more detail below. For example, the TPU material of the illustrated liner **304** may have the following properties: a specific gravity of about 1.19 g/cm^3; a shore hardness of about 73D (Shore A or D); a taber abrasion of about 75 mg loss; a DIN abrasion of about 35 mm^3 loss; an E-modulus of about 76,000 psi; a flexural modulus of about 73,000 psi; a tensile strength of about 7,100 psi; a tensile stress at 1000 elongation of about 5,600 psi; a tensile stress at 3000 elongation of about 7,100 psi; an ultimate elongation of about 3000; a tear strength of about 1,600 lb/in; a compression set of about 600 of original deflection for 22 h at 70° C. and about 400 of original deflection for 22 h at 23° C.; a glass transition temperature of about 33° C.; a vicat softening temperature of about 160° C.; and a DMA softening temperature of about 148° C. In one embodiment, the liner **304** has a thickness of about 0.7-1.0 mm. In other embodiments, the liner **304** may be formed from any suitable material and may have any suitable thickness.

FIGS. **12** and **13** are sections of the drive cap **300** in its assembled configuration (i.e., with the shell **302** formed over the liner **304**). The liner **304** defines the socket **330** within the shell **302**, and the socket **330** is generally polygonal when viewed from below (e.g., the socket **330** has a generally square cross-sectional shape in one embodiment) (FIGS. **6** and **11**). Suitably, the socket **330** may be shaped in any manner that facilitates transmitting torque to the blade **200**. In the illustrated embodiment, each of the tongues **340** is aligned with and extends into one of the grooves **326**, and each of the ledges **338** is aligned with and extends into one of the throughports **328**. In this manner, the shell **302** and the liner **304** are keyed to one another (e.g., in a tongue-and-groove or splined arrangement) to facilitate preventing rotation of the liner **304** relative to the shell **302**. Additionally, because the ledges **338** extend into the throughports **328**, removal of the liner **304** from the shell **302** is inhibited. In other embodiments, the shell **302** and the liner **304** may be keyed together in any suitable manner that facilitates preventing rotation of the liner **304** within the shell **302** and/or removal of the liner **304** from the shell **302**.

FIGS. **14** and **15** illustrate a torque transfer assembly **400** for use in rotating and pivoting the blade **200** of the inner cutter **100** via the drive cap **300**. The torque transfer assembly **400** generally includes a basket **402**, a biasing member **404** (e.g., in the illustrated embodiment a coil spring) sized to be seated within the basket **402**, and the drive pin **406** sized to be seated on the biasing member **404** within the basket **402**. The basket **402** includes a bottom wall **408** defining a receptacle **410**, and a generally cylindrical side wall **412** extending upward from the bottom wall **408** with a plurality of longitudinally extending channels **414** formed in the side wall **412**. Suitably, the receptacle **410** is sized to receive a drive shaft that is operatively connected to the motor of the shaver,

thereby enabling torque from the drive shaft to be transferred to the inner cutter **100** via the basket **402** and the drive pin **406**.

The illustrated drive pin **406** is hollow and includes an open bottom **416** and a closed tip **418**. The open bottom **416** has a plurality of guides **420** extending outward therefrom, wherein each guide **420** is sized to be inserted into, and to slide within, one of the channels **414** of the basket **402** such that the drive pin **406** is movable upward and downward within, and is rotatably immovable relative to, the basket **402**. Suitably, the drive pin **406** is externally sized (e.g., in transverse cross-section) such that a space is left between the drive pin **406** and the side wall **412** of the basket **402** when the drive pin **406** is disposed within the basket **402**, thereby enabling pivoting movement of the drive pin **406** relative to the basket **402**. The drive pin **406** is also sized internally (e.g., in transverse cross-section) to receive the biasing member **404** such that the drive pin **406** is biased away from the bottom wall **408** of the basket **402**. Additionally, the tip **418** of the drive pin **406** is generally polygonal when viewed from above (e.g., the tip **418** has a generally square cross-sectional shape in one embodiment) to facilitate insertion of the tip **418** into the socket **330** of the liner **304** for transferring torque from the basket **402** to the inner cutter **100** during a shaving operation (i.e., the generally polygonal tip **418** of the drive pin **406** is sized to mate with the generally polygonal socket **330** of the liner **304** such that rotation of the drive pin **406** causes the drive cap **300** to rotate).

In an assembled configuration of one embodiment of a shaver including the inner cutter **100** described above, the shaver includes a handle and a head mounted on the handle. An outer cutter blade (e.g., a stationary cutter blade) is mounted on the shaver head (e.g., pivotably mounted on the shaver head), and the blade **200** of the inner cutter **100** is disposed in shearing contact with the outer cutter blade. The blade **200** is connected to the drive cap **300** as described above, and the tip **418** of the drive pin **406** is inserted into the socket **330** of the drive cap **300**. To operate the shaver, a user grasps the handle and activates the motor. The motor rotates the arrangement of gears and drive shafts of the shaver drive system, one of the drive shafts being inserted into the receptacle **410** of the basket **402**. As such, the basket **402** rotates with the drive shaft, thereby rotating the drive pin **406** and the drive cap **300** for rotation of the blade **200** relative to the outer cutter blade of the shaver. The user then slides the outer cutter blade along the skin such that hairs from the skin are directed into slits of the outer cutter blade, wherein the hairs are cut via the rotating inner cutter blade **200**.

As the outer cutter blade traverses contours of the skin (e.g., the contours of the user's face), the outer cutter blade is permitted to float and/or pivot to facilitate maintaining the outer cutter blade in contact with the skin. When the outer cutter blade floats or pivots, the inner cutter **100** floats or pivots in unison with the outer cutter blade, being that the inner cutter **100** is disposed within the outer cutter blade. As the inner cutter **100** floats/pivots, the basket **402** of the torque transfer assembly **400** is maintained in a fixed position relative to the drive shaft of the shaver because the basket **402** is fastened atop of the drive shaft via the receptacle **410**. However, the drive pin **406** is permitted to float and pivot within the basket **402** against compression of the biasing member **404**, thereby maintaining a driving engagement between the drive pin **406** and the drive cap **300** of the inner cutter **100** despite the floating and/or pivoting of the inner cutter **100**. In this manner, the inner cutter blade **200** is maintained in shearing contact with the outer cutter blade while the outer cutter blade floats/pivots.

Depending upon the pivot angle of drive cap **300** (either at rest or during shaving), the entire surface of the tip **418** may not be in contact with the liner **304** at all times due in part, for example, to the pivot constraints of the drive pin **406** within the basket **402** (e.g., the drive cap **300** may be pivoted into an angle that the drive pin **406** cannot achieve). Thus, separation of the drive cap **300** from the tip **418** of the drive pin **406** may occur within the socket **330**, which can result in increased noise or "chatter" associated with operation of the shaver as gaps between the rotating drive pin **406** and the rotating drive cap **300** open and close due to the inner cutter **100** and the drive pin **406** pivoting relative to one another. Because the material from which the liner **304** is manufactured (e.g., the TPU material) is softer than the material from which shell **302** and/or the tip **418** are manufactured, the liner **304** facilitates cushioning the connection between the drive pin **406** and the shell **302**, thereby mitigating noise associated with shaver operation (i.e., the liner **304** absorbs impacts of the tip **418** against the drive cap **300** within the socket **330** during pivoting/floating of the inner cutter **100**).

With this configuration, the drive cap **300** is configured to operatively connect the blade **200** to a motor of the rotary shaver. As such, the drive cap **300** and the torque transfer assembly **400** are components of a drive system of a rotary shaver, which also includes a motor, a gear arrangement, and at least one drive shaft. It is contemplated that any suitable component of the drive system (e.g., a drive shaft tip or a gear tooth) of any suitable shaver type (e.g., an oscillating shaver or a rotary shaver) may be configured with the liner **304** in a manner similar to that of drive cap **300** described above in order to facilitate mitigating noise associated with the interaction of the drive system components during operation. For example, in one suitable embodiment, the tip **418** of the drive pin **406** may be fitted with the liner **304** in lieu of, or in conjunction with, the shell **302** of the drive cap **300** being fitted with the liner **304**.

When introducing elements of the present invention or the preferred embodiment(s) thereof, the articles "a", "an", "the", and "said" are intended to mean that there are one or more of the elements. The terms "comprising", "including", and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An electric shaver comprising:

a handle;

a head connected to the handle, wherein the head comprises an outer cutter blade and an inner cutter blade arranged in shearing contact with the outer cutter blade; and

a drive system comprising a motor and a plurality of drive components drivingly connecting the motor to the inner cutter blade for driving rotation of the inner cutter blade relative to the outer cutter blade, wherein the plurality of drive components comprises a first drive component and a second drive component connected to the first drive component, wherein at least one of the first drive component and the second drive component comprises a liner for cushioning the interface between the first drive component and the second drive component to mitigate noise associated with operation of the shaver.

2. The electric shaver set forth in claim **1** wherein the liner is formed from a thermoplastic elastomer (TPE) material.

3. The electric shaver set forth in claim 1 wherein the second drive component is configured to receive the first drive component.

4. The electric shaver set forth in claim 3 wherein the first drive component comprises the liner.

5. The electric shaver set forth in claim 3 wherein the second drive component comprises the liner.

6. The electric shaver set forth in claim 1 wherein the second drive component is pivotable relative to the first drive component.

7. The electric shaver set forth in claim 6 wherein the electric shaver is a rotary electric shaver, the outer cutter blade and the inner cutter blade being pivotable on the head of the shaver, wherein the first drive component and the second drive component are pivotably connected to one another such that the inner cutter blade is drivable during pivoting.

8. The electric shaver set forth in claim 7 wherein the first drive component is a drive pin and wherein the second drive component is a drive cap to which the inner cutter blade is connected, the drive cap having a socket defined by the liner such that the drive pin is insertable into the socket for driving the inner cutter blade.

9. The electric shaver set forth in claim 8 wherein the socket is generally polygonal and wherein the drive pin comprises a tip that is generally polygonal.

10. The electric shaver set forth in claim 8 wherein the drive cap comprises a shell having an interior lined by the liner to define the socket, the shell being formed from a first material having a first hardness, the liner being formed from a second material having a second hardness that is less than the first hardness.

11. The electric shaver set forth in claim 10 wherein the second material is a thermoplastic elastomer (TPE) material.

12. The electric shaver set forth in claim 10 wherein the liner and the shell are keyed to one another to facilitate preventing rotation of the liner relative to the shell.

13. An inner cutter for an electric shaver, said inner cutter comprising:

a blade; and

a drive cap to which the blade is connected, the drive cap comprising a shell and a liner, wherein an interior of the shell is lined by the liner such that the liner defines a socket, the shell being formed from a first material having a first hardness, the liner being formed from a second material having a second hardness that is less than the first hardness.

14. The inner cutter set forth in claim 13 wherein the second material is a thermoplastic elastomer (TPE) material.

15. The inner cutter set forth in claim 13 wherein the liner and the shell are keyed to one another to facilitate preventing rotation of the liner relative to the shell.

16. The inner cutter set forth in claim 13 wherein the socket is configured to receive a drive component.

17. The inner cutter set forth in claim 16 wherein the socket is configured to permit pivoting of the drive cap on the drive component.

18. The inner cutter set forth in claim 16 wherein the socket is generally polygonal.

19. The inner cutter set forth in claim 18 wherein the generally polygonal socket has a generally square cross-sectional shape.

20. An electric shaver comprising:

a handle;

a head connected to the handle, wherein the head comprises an outer cutter blade and an inner cutter blade arranged in shearing contact with the outer cutter blade; and

a drive system comprising a motor and a plurality of drive components drivingly connecting the motor to the inner cutter blade for driving the inner cutter blade relative to the outer cutter blade, wherein the plurality of drive components comprises:

a drive cap to which the inner cutter blade is connected, the drive cap comprising a shell and a liner, wherein an interior of the shell is lined by the liner such that the liner defines a socket, the shell being formed from a first material having a first hardness, the liner being formed from a second material having a second hardness that is less than the first hardness; and

a torque transfer assembly comprising a basket, a biasing member seated within the basket, and a drive pin connected to the basket atop of the biasing member such that the drive pin is floatable, pivotable, and rotatably immovable relative to the basket,

wherein the torque transfer assembly drivingly connects the motor to the drive cap with the drive pin inserted into the socket such that the liner cushions the interface between the drive pin and the drive cap to mitigate noise associated with operation of the shaver.

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